MAGMA

MAGMA COPPER COMPANY

FLORENCE PROJECT

Rec'd 9/14/95

September 8, 1995

Ms. Shirin Tolle
Aquifer Protection Project Officer
Arizona Department of Environmental Quality
3033 North Central Avenue
Phoenix, Arizona 85012

15-1899/43

Subject: Magma Copper Company, Florence Project
Monthly Progress Report
August 1995

Dear Ms. Tolle:

Magma Copper Company (Magma) is pleased to provide the August 1995 Progress Report for the Florence Project.

Drilling and Well Installation Progress

A total of 52 wells have been installed: 18 monitoring wells, 17 pumping wells, and 17 observation wells (see Table 1). All of the proposed monitoring wells and 9 aquifer test well clusters have been installed. A summary of monitor well pump installation data is shown on Table 2. A full suite of geophysical logs was completed in P8.1-O during August (see Table 3). No packer testing activities occurred in August, however, preliminary analyses of slug test data collected for selected corehole intervals is shown on Table 4.

During August, aquifer tests were completed in all monitoring wells and one well cluster (P28.1-O, P28.2-O, and P28-GL). Heat pulse logs were completed in wells O28.1-O and P28.2-O and large-scale aquifer tests were completed using two irrigation wells. Analysis and presentation of the test results is scheduled to be completed during the month of September.

Drilling activities in September are scheduled to include the completion of the vadose zone sampling program which also incorporates the geotechnical investigation program required for the facility designs.

Sampling Activities

Groundwater samples were collected from all 18 monitoring wells. Water samples were also collected from the irrigation canal, air shaft, and the drill water supply tank. Organic analyses

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were included for the August sampling event. Laboratory reports are anticipated to be issued by September 15, 1995. Groundwater sampling of all monitoring wells is scheduled to begin the week of September 11, 1995.

Modeling Activities

Modeling activities during August were focused on the input of the regional bedrock surface and model calibration with the May 1995 water level measurements for the regional area. Initial simulations have begun for extreme flood and drought scenarios, and extreme changes in the groundwater conditions near the proposed in-situ mine area. At this time additional layers are being added to the model in the immediate area of the proposed in-situ mine.

Column testing was completed during August. Additional attenuation testing will occur in September using previously leached materials and the Gila Conglomerate material.

Aquifer Protection/Underground Injection Control (UIC) Permit Activities

The third update meeting for the Aquifer Protection Permit (APP) Application was held on August 16, 1995, and included a review of the geostatistical analyses on fracture intensity data, preliminary facility designs, groundwater flow modeling scenarios, aquifer test rationale, aquifer test results and discussions on the three plans submitted for review on June 27, 1995. Additional review comments were provided by the Arizona Department of Environmental Quality (ADEQ) on August 25, 1995 for the following submittals:

- Hydrogeologic Investigation for Prefeasibility Studies, February 1, 1994
- APP Permit Application Work Plan, February 2, 1995
- Work Plan Response to Supplemental Items, April 28, 1995
- Groundwater Sampling and Analysis Plan, June 27, 1995
- Vadose Zone Sampling and Analysis Plan, June 27, 1995
- Corehole Abandonment Work Plan, June 27, 1995

Additional Activities During August

One aquifer test was completed on well P28.2-O during August. The duration of the aquifer test was approximately 4,000 minutes. Two large-scale aquifer tests were completed using two irrigation wells (WW-3 and BIA-9). The duration of these tests was approximately 8,600 minutes. Continuous recording devices (data loggers with transducers) were installed at 3 observation wells in the in-situ mine area. Evaluation of this data will be completed in September. An additional series of aquifer tests (8 to 10) are scheduled to be completed prior to submittal of the APP Application for the Florence Project.

The fourth APP Application meeting is scheduled for the first week in October, 1995 at the ADEQ office in Phoenix. The Florence Project Team looks forward to presenting the

modeling results of the groundwater scenarios requested by Gila Indian River Community. If you have any questions, please do not hesitate to contact me at (520) 868-5094 or Mr. Steve Mellon at Brown and Caldwell, telephone number (602) 222-4445.

Very truly yours,

John Kline
Environmental Project Manager

SAM:kw
Attachment

cc: Mr. Bruce Gaither, Digital Precision GeoScience
Mr. Jose Gutierrez, USEPA
Mr. Steve Mellon, Brown and Caldwell
Mr. Dan Ramey, Magma Copper Company
Mr. Terry Steinborn, Applied Research Associates, Inc.

Table 1. Well Installation Data

Well Number	Total Depth (feet)	Screen				Casing		Borehole Diameter (inches)
		Type	Diameter (inches)	Slot Size (inches)	Depth (feet)	Type	Diameter (inches)	
M1-GL	420	PVC	5	0.08	315 to 355	PVC	5	9 7/8
M2-GU	270	PVC	5	0.08	198 to 258	PVC	5	9 7/8
M3-GL	370	PVC	5	0.08	298 to 338	PVC	5	9 7/8
M4-O	510	PVC	5	0.08	405 to 465	PVC	5	9 7/8
M5-S	613	PVC	4	0.08	516 to 576	LCS	5 and 4[a]	9 7/8
M6-GU	590	PVC	5	0.08	524 to 564	PVC	5	9 7/8
M7-GL	940	PVC	4	0.08	859 to 919	LCS	5 and 4[b]	9 7/8
M8-O	1,115	PVC	4	0.08	1,010 to 1,070	LCS	5 and 4[c]	9 7/8
M9-S	1,578	SS	4	0.08[d]	1,510 to 1,570	LCS	5 and 4[e]	9 7/8
M10-GU	290	PVC	5	0.08	218 to 258	PVC	5	9 7/8
M11-GL	370	PVC	5	0.08	290 to 330	PVC	5	9 7/8
M12-O	510	PVC	5	0.08	420 to 480	PVC	5	9 7/8
M13-S	943	PVC	5	0.08	851 to 911	LCS	5	9 7/8
M14-GL	950	PVC	5	0.08	778 to 838	LCS	5	9 7/8
M15-GU	630	PVC	5	0.08	554 to 594	LCS	5	9 7/8
M16-GU	690	PVC	5	0.08	598 to 658	PVC	5	9 7/8
M17-GL	1,132	PVC	5	0.08	938 to 998	LCS	5	9 7/8
M18-GU	240	PVC	5	0.08	178 to 218	PVC	5	9 7/8
O3-GL	395	PVC	5	0.08	325 to 365	PVC	5	9 7/8
P5-O	800	PVC	6	0.08	414 to 770[f]	PVC	6	10 5/8
O5.1-O	880	PVC	4	0.08	672 to 832	LCS	5 and 4[g]	9 7/8
O5.2-O	880	PVC	4	0.08	712 to 771	PVC	4	8 3/4
P8.1-O	616	PVC	6	0.08	400 to 580	PVC	6	10 5/8
P8.2-O	610	PVC	6	0.08	396 to 596	PVC	6	10 5/8
O8-O	610	PVC	4	0.08	402 to 580	PVC	4	8 3/4
P8-GU	270	PVC	6	0.08	128 to 248	PVC	6	10 5/8
O8-GU	270	PVC	4	0.08	133 to 252	PVC	4	8 3/4
P12-O	999	PVC	6	0.02	440 to 940	PVC	6	10 5/8
O12-O	970	PVC	4	0.08	434 to 929	PVC	4	8 3/4
O12-GL	395	PVC	5	0.08	325 to 365	LCS	5	9 7/8

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Well Number	Total Depth (feet)	Screen				Casing		Borehole Diameter (inches)
		Type	Diameter (inches)	Slot Size (inches)	Depth (feet)	Type	Diameter (inches)	
P13.1-O	1,471	PVC	6	0.08	772 to 1,450	LCS	6	10 5/8
P13-GL	770	PVC	6	0.08	690 to 750	PVC	6	10 5/8
P13.2-O	1,400	LCS	6	0.08	780 to 1,380	LCS	6	10 5/8
O13-O	1,436	PVC	4	0.08	770 to 1,394	PVC	4	8 3/4
P15-GL	500	PVC	6	0.08	421 to 481	PVC	6	10 5/8
P15-O	1,380	PVC	6	0.08	550 to 1,300	PVC	6	10 5/8
O15-O	1,330	PVC	4	0.08	632 to 1,297	PVC	4	8 3/4
P19.1-O	630	PVC	6	0.08	402 to 602	PVC	6	10 5/8
P19.2-O	630	PVC	6	0.08	404 to 604	PVC	6	10 5/8
O19-O	630	PVC	4	0.08	410 to 610	PVC	4	8 3/4
O19-GL	460	PVC	5	0.08	375 to 435	PVC	5	9 7/8
P28.1-O	520	PVC	6	0.08	399 to 499	PVC	6	10 5/8
P28.2-O	519	PVC	6	0.08	398 to 498	PVC	6	10 5/8
P28-GL	320	PVC	5	0.08	279 to 309	PVC	5	9 7/8
O28.1-O	530	PVC	4	0.08	395 to 495	PVC	4	8 3/4
O28.2-S	510	PVC	4	0.08	454 to 494	PVC	4	8 3/4
O28-GL	320	PVC	4	0.08	277 to 307	PVC	4	8 3/4
P39-0	915	PVC	6	0.08	471 to 826	PVC	6	10 5/8
O39-0	916	PVC	5	0.08	474 to 890	PVC	5	9 7/8
P49-O	1,288	PVC	6	0.08	807 to 1,222	PVC	6	10 5/8
O49-O	1,280	PVC	4	0.08	832 to 1,232	PVC	4	8 3/4
O49-GL	740	PVC	5	0.08	660 to 720	LCS	5	9 7/8

[a] Casing reduction from 5 inches to 4 inches at 516 feet below the ground surface (bgs).
[b] Casing reduction from 5 inches to 4 inches at 593 feet bgs.
[c] Casing reduction from 5 inches to 4 inches at 591 feet bgs.
[d] Wire wrap screen.
[e] Casing reduction from 5 inches to 4 inches at 502 feet bgs.
[f] Screen interval contains 220 feet of slotted screen and 140 feet of blank casing because of material shortages. Location of blank casings were placed in areas of lower permeability as determined by the geophysical logs.
[g] Casing reduction from 5 inches to 4 inches at 494 feet bgs.

PVC = polyvinyl chloride
LCS = low carbon steel
SS = stainless steel

All casing and screen diameters are nominal sizes.
All PVC casing and screen Schedule 80.
All LCS casing and screen Schedule 40.

Table 2. Summary Monitor Well Pump Installation Data

Well Identification	Pump Horsepower	Top Well Screen (feet below surface)	SWL (feet from top of sounding tube)	Pump Model	Installed Pump Depth (feet below surface)	Discharge Pipe Material
M1-GL	1½	315	136	10S-10-15	280	PVC
M2-GU	1½	198	108	10S-10-15	180	PVC
M3-GL	1½	298	111	10S-10-15	200	PVC
M4-O	1½	405	111	10S-15-21	380	PVC
M5-S	5	516	167	25S-20-26E	500	PVC
M6-GU	2	524	150	10S-20-27	500	PVC
M7-GL	5	859	159	10S-50-58DS	580	PVC
M8-O	1½	1,011	158	7S-15-26	580	PVC
M9-S	5	1,510	163	10S-50-48DS	1,390	FRP
M10-GU	1½	218	124	10S-10-15	200	PVC
M11-GL	1½	290	130	10S-10-15	260	PVC
M12-O	1½	420	130	10S-15-21	260	PVC
M13-S	5	859	150	16S-50-38	840	FRP
M14-GU	1½	778	160	10S-10-15	260	PVC
M15-GL	1½	554	158	10S-10-15	260	PVC
M16-GU	1½	598	159	5S-10-22E	260	PVC
M17-GL	1½	938	160	10S-15-21	340	PVC
M18-GU	1½	178	117	10S-10-15	170	PVC

Notes:

Assume pump level = pump depth. All pumps 460V Phase 3 and 3.75-inch outside diameter (exception: 10S-50-58DS = 4.25-inch outside diameter)

PVC = polyvinyl chloride (national pipe thread with stainless steel couples); 1¼-inch diameter

FRP = fiberglass reinforced pipe (DST 1010 bell and spicket type; 1½-inch diameter)

All installations include 1½-inch diameter Schedule 40 flush thread sound tube to pump depth (FRP installations: 1-inch diameter)

All pumps designed to produce 5 to 10 gallons per minute (gpm) (M9-5 produces 1 gpm)

Table 3. Geophysical Logs

Hole Number	Total Depth (feet)	Type of Geophysical Log										Comments
		BHT	Resistivity	S.P.	Caliper	Temperature	Gamma Ray	Neutron	Density	Sonic	Spinner	
M1-GL	420	NR	√	√	NR	NR	√	√	NR	NR		
M5-S	610	NR	√	√	√	NR	√	√	√	√		Clay Seam in Gila Conglomerate
M6-GU	590	NR	NR	NR	NR	NR	NR	NR	NR	NR		
M7-GL	940	NR	NR	NR	NR	NR	NR	NR	NR	NR		
M8-0	1,115	NR	NR	NR	NR	NR	NR	NR	NR	NR		
M9-S	1,578	NR	√	√	√	√	√	√	NR	√		Clay Seam in Gila Conglomerate
M10-GU	290	NR	NR	NR	NR	NR	NR	NR	NR	NR		
M11-GL	370	NR	NR	NR	NR	NR	NR	NR	NR	NR		
M12-O	510	NR	NR	NR	NR	NR	NR	NR	NR	NR		
M13-S	943	NR	√	√	√	NR	√	√	√	√		Clay Seam in Gila Conglomerate
M14-GL	950	NR	√	√	√	√	√	√	NR	√		Clay Seam in Gila Conglomerate
M17-GL	1,132	NR	√	√	√	NR	√	√	√	NR		
O3-GL	395	NR	NR	NR	NR	NR	NR	NR	NR	NR		
O5.1-O	880	NR	√	√	√	NR	√	√	√	√		Clay Seam in Gila Conglomerate
O5.2-O	880	NR	√	√	√	√	√	√	NR	√		Clay Seam in Gila Conglomerate
P8.1-O	616	NR	√	√	NR	NR	√	√	NR	√		
P12-0	999	NR	√	√	√	NR	√	√	√	√		
O12-O	970	NR	NR	NR	NR	NR	NR	NR	NR	NR		
O12-GL	395	NR	NR	NR	NR	NR	NR	NR	NR	NR		

Table 3. Geophysical Logs

Hole Number	Total Depth (feet)	Type of Geophysical Log										Comments
		BHT	Resistivity	S.P.	Caliper	Temperature	Gamma Ray	Neutron	Density	Sonic	Spinner	
P28.2-O	519	NR	√	√	NR	NR	√	√	NR	√		
O28.2-S	1,510	NR	√	√	NR	NR	√	√	NR	√		
P19.1-O	630	NR	√	√	NR	√	√	√	NR	√	√	Fault Contact
O19-GL	460	NR	√	NR	NR	NR	√	NR	NR	NR		
O39-0	916	NR	√	√	√	NR	√	√	√	√		
P49-O	1,280	NR	√	√	√	√	√	√	NR	√		Clay Seam in Gila Conglomerate
MCC-533[a]	1,073	√	√	√	√	NR	√	√	NR	√		Fracture Orientations
MCC-537[b]	1,207	√	√	√	√	NR	√	√	NR	√		Clay Seam in Gila Conglomerate
MCC-540[b]	1,176	√	√	√	√	NR	√	√	NR	√		Fracture Orientations
MCC-541[b]	1,031	√	√	√	√	NR	√	√	NR	√		Fracture Orientations
MCC-544[b]	1,320	√	√	√	√	NR	√	√	NR	√		Fracture Orientations

[a] 6-inch core hole NR = not run

[b] HX core hole BHT = Borehole Televiewer Log

Table 4. Magma Florence Project, Summary of Coring and Packer Testing Data				
			Packer Test Data	
Corehole ID	Test Interval (feet below surface)	Rock Type - Zone	Fracture Gradient psi/ft	Slug Test Hydraulic Conductivity ft/day
MCC-533	860 to 896	Quartz Monzonite Porphyry - Oxide	0.71	NT
	740 to 776	Quartz Monzonite Porphyry - Oxide	0.73	NT
	655 to 691	Quartz Monzonite Porphyry - Oxide	0.80	NT
	605 to 641	Quartz Monzonite Porphyry - Oxide	0.82	NT
MCC-537	470 to 521	Quartz Monzonite - Oxide	0.71	0.085
	395 to 446	Quartz Monzonite - Oxide	0.75	NT
MCC-540	1,061 to 1,097	Granodiorite - Oxide	0.93	NT
	983 to 1,019	Quartz Monzonite Porphyry and Andesite - Oxide	0.84	0.02
	925 to 976	Granodiorite and Quartz Monzonite Porphyry	0.81	0.057[a]
	651 to 702	Quartz Monzonite Porphyry - Oxide	0.85	0.1
	504 to 555	Quartz Monzonite Porphyry - Oxide	Note [b]	0.7
MCC-541	507 to 543	Quartz Monzonite Porphyry - Oxide	Note [c]	0.038
MCC-544	913 to 1,305	Quartz Monzonite Porphyry - Oxide, Sulfide	NT	0.049
	1,148 to 1,305	Quartz Monzonite Porphyry - Oxide, Sulfide	NT	0.0055
	1,253 to 1,305	Quartz Monzonite Porphyry - Oxide	0.69	Note [d]
	1,000 to 1,066	Quartz Monzonite Porphyry - Oxide	0.85	0.0043
	898 to 964	Quartz Monzonite Porphyry - Oxide	0.77	Note [e]
	425 to 491	Quartz Monzonite Porphyry - Oxide	0.60	0.72
	389 to 425	Quartz Monzonite Porphyry - Oxide	0.82	0.057

NT = No test

Units:

psi/ft = pounds per square inch per foot
ft/day = feet per day

[a] Influence from irrigation well on slug test.
[b] Unable to induce fracture flow at applied pressure - no fracture gradient value.
[c] Unreliable flow rate data obtained during injection due to pump problems - no fracture gradient value.
[d] Slug test attempted - formation would not take fluid.
[e] Slug test attempted - formation took fluid at extremely slow rate.